



Static Bonding and Grounding When Handling Flammable and Combustible Fuels

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Build-up of static electricity must be minimized during agitation, dispensing (spraying or pouring), and transporting of flammable fuels on or around containers and dispensing equipment. The most effective safeguard is to bleed off any static charge to prevent sparking. Fire and explosion can result when static electricity discharges at or near the mouth of a container of highly flammable fuel such as gasoline. Unbonded 5-gallon gasoline cans that were being filled have

exploded in plastic lined pick-up trucks. There have also been explosions when plastic cans were being filled with gasoline in unlined pickups.

There are two basic techniques for protecting against the dangers of static electricity: bonding and grounding. These techniques should be strictly followed in areas where flammable and combustible liquids are stored, dispensed, or used.

Bonding is the process of joining two or more objects or containers with electrically conductive wires to neutralize the potential charge between them. Connecting two metal objects with any length and size of wire may not meet accepted standards for proper bonding. Use a heavy 12-gauge (.205 centimeters) stranded wire that can stand up to continuous use (Figure 1). These are generally available on reels or in individual specified lengths (Figure 2) from industrial suppliers.



Figure 1.—Twelve-gauge bonding wire with clip.



Figure 2.—Bonding and grounding wire.



Grounding is the process of connecting one or more objects or containers to the ground and is a specific form of bonding. Grounding may be achieved by attaching a wire conductor between the container and a water pipe or an 8-foot (2.44 meters) long copper clad steel rod buried its full length in the ground (Figure 3). Total resistance to ground must be kept below 10,000 ohms (National Fire Protection Association, NFPA #407, Aircraft Service Guide). Note: When using a buried rod, resistance is affected by soil moisture.

Federal and local codes require grounding and bonding connections during gravity transfer of flammable liquids from 55-gallon (208 liter) storage drums to approved safety containers. The drum itself must be grounded, then bonded to the smaller container no matter what types of material they are made from (Figures 4 and 5). Bonding wires fitted with a wide variety of approved clamps, “c”-clamps, pipe clamps, and alligator clips are available.

To minimize the possibility of fire and explosion, static grounding and bonding is also required on fuel handling equipment. Vehicles and fixed dispenser units that service aircraft at a rate of over 25 gallons per minute (95 liters/min) through a hose not less than 1-1/4-inch (3.175 centimeters) in diameter, must have a single wire branch to a “y” configuration with two ground clamps (Figure 6). One grounding clamp is fastened to a suitable ground (see Figures 1-6) and the other is fastened to the equipment to be fueled. This configuration is also recommended for all other fuel servicing equipment.

In some cases bonding is accomplished through a wire-braided hose that bonds the nozzle to the dispensing tank (typical of service stations). This does not bond the tank being filled to the dispensing tank until the nozzle makes physical contact with the fill spout. **This is not an acceptable bonding technique for any other fuel handling and transfer operation except those using dry break valves (helitorch) or those where the fill spout is equipped with an anti-flashback device (screen or flapper, see Figure 7).**



Figure 3.—Grounding to pipe.



Figure 4.—Grounding plastic can.



Figure 5.—Bonding plastic can to barrel.



Figure 6.—"Y" ground configuration.



Figure 7.—Safety can and anti-flashable screen.

Other safeguards that minimize the static electricity hazard include:

- ✦ Remove small containers from vehicles before dispensing fuel.
- ✦ Ground and/or bond all containers before opening and dispensing fuel.
- ✦ Physically touch the outside of containers, grounds, and bond wires to bleed excess charges off your body.
- ✦ Touch the outside of metal and plastic containers with the fill nozzle before opening and dispensing fuel.
- ✦ Use labeled safety containers with anti-flashback systems installed.
- ✦ Do not use old or rusty containers or worn bonding and grounding clamps or worn and frayed wires.
- ✦ Turn off all engines and equipment except those used in the fuel transferring process.
- ✦ When handling fuels, avoid synthetic fabrics. Wear cotton clothing and coveralls to minimize static build-up.
- ✦ Avoid the use of velcro on or around fuel dispensing and handling equipment.
- ✦ Do not use chamois to filter flammable fuels.
- ✦ Do not use radio transmission equipment around refueling systems.

For additional information on static bonding and grounding, contact Jim Tour at the Missoula Technology & Development Center.

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